Microplasma-assisted and one-step fabrication of silver nanoparticle / paper for disposable 3D surface-enhanced Raman scatting substrate

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Abstract

Surface-enhance Raman scattering (SERS) is emerging as a powerful technology for the label-free detection of various biological and chemical species. One of the important but often overlooked considerations in the design of surface-enhanced Raman scattering (SERS) substrates for trace detection is the efficiency of sample collection. Conventional designs based on rigid substrates such as silicon, alumina, and glass resist conformal contact with the surface under investigation, making the sample collection inefficient.

Here we present microplasma-assisted and one-step fabrication of silver nanoparticle (AgNP) /paper using microplasmas. The aim of our work is to develop an effective SERS substrate based on common filter paper loaded on silver nanoparticles. Microplasmas can be operated stably with an aqueous solution as an electrode at atmospheric pressure. Energetic species formed in the microplasma are capable to initiating electrochemical reactions and nucleating particles in solution without chemical reducing agents. In our work, we found Ag NP can be synthesized and in a minute time scale. We further extend this technology to fabricated AgNPs /paper and characterized them by SEM, Raman, SAXS and x-ray diffraction spectroscopies. The Raman response of the AgNP/paper composite were performed using Rhodamine 6G (R6G) , folic acid (FA) as the Raman probe. Overall, our study provides that AgNP/paper shows superior SERS performance, leading a potential application for disposable SERS substrates.

Keywords –Surface-enhanced Raman Scatting, Disposable strip,Microplasma,3D structure , silver nanoparticle